NATURAL RESOURCES CONSERVATION SERVICE
PACIFIC BASIN AREA
CONSERVATION PRACTICE STANDARD

COMPOSTING FACILITY

(Number)
CODE 317

DEFINITION

A facility for the biological stabilization of waste organic material.

PURPOSE

To treat organic waste material biologically producing a humus-like material that can be recycled as a soil amendment and fertilizer substitute or otherwise used in compliance with all laws, rules and regulations. Waste organic material for composting may include livestock or poultry manure, dead animal carcasses, and food processing wastes where food is processed as part of normal farming operation. Municipal sludge, solid waste, and other non-farm type wastes are not included in this standard.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where all of the following conditions exist:

1. Waste organic material is generated by agricultural production or processing.
2. Composting is needed to manage the waste organic material properly.
3. A Nutrient Management plan, as required in the Pacific Basin standard, Nutrient Management (590), accounts for the end use of the composted material.

CRITERIA

Design

Soils. Locate composting facilities on soils having slow to moderate permeability to minimize seepage of dissolved substances into the soil profile and movement toward groundwater. Evaluate site paving needs in terms of effects of equipment operation on trafficability, soil compaction, and potential for contamination from compost and petroleum products.

Runoff. Divert surface runoff from outside drainage areas around the compost facility with the appropriate practices (diversion, waterway, dike, hillside ditches, underground outlet, roof runoff management). Collect runoff from compost facility and utilize or dispose of it properly. Evaluate the effects of changed infiltration conditions on groundwater recharge, and evaluate changes in volumes and rate of runoff caused by the location of the operation. Properly manage movement of organic material, soluble substances, and substances attached to solids carried by runoff.

Carbon-Nitrogen Ratio. Compute the carbon nitrogen ratio in accordance with the guidelines in the Agricultural Waste Management Field Handbook (AWMFH, Chapter 10, Component Design). Where moisture content exceeds optimum, rather than increase volume by adding dry matter, proportion mix based on C:N ratio, then make provisions for proper air flow through the material and exclusion of outside moisture. The composting mass will then dry through the critical moisture. Use the higher range of C:N (towards 40), for organic materials that decompose at a high rate (or are highly unstable) which are usually associated high odor production.

Where more than two ingredients are to be blended, the two main ingredients are to be used in the analysis for the desired C:N and mixed accordingly. Adding up to 50 percent by weight of other ingredients to improve workability and air movement is permissible as long as the C:N of the added ingredient does not exceed the target C:N of the compost.

Odor. Select carbonaceous material that, when blended with the nitrogenous material, will result in the desired pH. The blended

material should have a pH at or slightly below neutral for best odor control. Where odors do not present a problem, pH of 8 to 9 is acceptable, but strong ammonia and amine related odors will be present for up to the first 2 weeks.

Locate composting operations where movement of any odors toward neighbors will be minimized. An awareness of prevailing wind direction for the site is essential. Buffer areas, vegetative screens, and natural landscape features can help minimize effects of odors.

Facility Size. Where dead poultry and other small farm animals are composted, establish the size of the compost units on the basis of locally determined animal loss rates. Composting facilities for the purpose of processing animal carcasses are to include a primary composting unit into which alternate layers of low moisture content manure, carbon source material (woodchips is common), and dead animal carcasses are placed. A secondary composting unit is often necessary to complete the composting process.

Moisture. The moisture content of the blended material at start-up of the composting process should be approximately 60 percent (wet weight basis) and maintained between 40 and 60 percent during the composting process . Where moisture contents are higher, see guidance under Carbon Nitrogen ratio, above. The composting process may become inhibited when moisture falls below approximately 40 percent. Water used for the moisture control must be free of deleterious substances.

Pile Configuration. Compost piles should be adapted to the site and follow the guidance in component design for composting facility in Chapter 10 of the AWMFH. Increased surface area favorably affects evaporation and natural aeration and increases the area exposed to infiltration from precipitation in uncovered stacks. Windrows should be aligned to avoid accumulation of precipitation.

Composting Period. The time needed for completion of the process varies with the material and must continue until the material reaches a stability level at which it can be safely stored or utilized without creating undesirable odors and poor handling features. Visual inspection and temperature measurements will provide needed evaluation of compost status.

Storage. When storage is a planned for any conservation plan in the Pacific Basin, it shall be sized for a storage period meeting the requirements of the operation and any concerns as described in the Pacific Basin standard, Waste Utilization (633). Structures must meet the requirements of the Pacific Basin standard, Waste Storage Facility (313).

Operational Temperature. Operating temperature of the compost process should be 130^0 to 170^0 Fahrenheit (54.4^0 to 77.7^0 Celsius). If the material is insufficient in mass or of inadequate composition, then it will not go through the heat and composting is not taking place. The practice is functioning as a Waste Storage Facility (313). The composting facility should reach operating temperature within about 7 days and remain elevated for up to 14 days to facilitate efficient composting. The temperature should remain at or above 110^0 F (43^0 Celsius) for the remainder of the designated composting period.

If temperature falls significantly during the composting period and odors develop, or if material does not reach operating temperature, investigate piles for moisture content, porosity, and thoroughness of mixing. Compost managed at the required temperatures will favor destruction of pathogens and weed seeds.

Aeration. Heat generated by the process causes piles to dehydrate. As the process proceeds, material consolidates, and the volume of the voids through which air flows decreases. Materials selected for composting mix should provide for adequate air movement through the composting process. Frequency of turning the pile and guidance for maintaining proper moisture shall be included in the operations guidance provided to the operator.

Nutrients. Keep compost well aerated to minimize nitrogen loss by denitrification. Keep pH at neutral or slightly lower to avoid nitrogen loss by ammonification. High amounts of available carbon will aid nitrogen immobilization. Phosphorus losses will be minimized when the composting process is managed according to the requirements of this standard. Include compost nutrients in nutrient management plans; and determine the effects of use and management of nutrients on the quality of surface water and ground water.

Testing Needs. Testing of compost material shall be appropriate for the size of the operation and the ultimate disposition of the processed material, e.g. marketed compost will need to be of greater uniformity and higher quality than that applied to cropland. Larger, more sophisticated operations may require testing for carbon, nitrogen, moisture, and pH as part of the troubleshooting process, (if compost fails to reach desired temperature or if odor problems develop). Composted materials that are for the retail market will require testing for labeling purposes.

CONSIDERATIONS

PLANNING CONSIDERATIONS

Types. Three types of composting operations are covered in this standard; aerated windrows, static piles, and in vessel.

Aerated windrows are more suited to large volumes of organic material that are managed by power equipment used to turn the composting material periodically. Periodic turning re-aerates the windrows, promoting the composting process.

Organic material in static piles is initially mixed to a homogeneous condition and not turned again throughout the composting process. Static pile material must have the proper moisture content and bulk density to facilitate air movement throughout the pile. Forced air may be necessary to facilitate the composting process.

In-vessel composting in a totally enclosed structure is carried out on a blended organic material under conditions where temperature and air flow are strictly controlled. In-vessel composting also includes naturally aerated processes where organic materials are layered in the vessel in a specified sequence. Layered, in-vessel materials are usually turned once to facilitate the process. Vessel dimensions must be consistent with equipment to be used for the management of compost.

Process. Composting is accomplished by mixing an energy source (carbonaceous material) with a nutrient source (nitrogenous material) in a prescribed manner to meet aerobic microbial metabolic requirements. The process is carried out under specific moisture and temperature conditions for a specified period of time. Correct proportions of the various compost ingredients are essential to minimize odors to avoid attracting flies, rodents, and other small animals.

Carbon Source. A dependable source of carbonaceous material must be available. The material should have high carbon content and high carbon to nitrogen ratio (C:N). Woodchips, sawdust, cardboard, paper, coconut husks and palm fronds are good sources of carbon. Carbon sources and ratios can be found in the Agricultural Waste Management Field Handbook (Part 651 of the National Engineering Handbook), page 10-47.

Moisture Control. Large amounts of water evaporate during the composting process because operating temperatures drive off water. A source of water must be available for compost pile moisture control from start-up through completion. Proper moisture facilitates the composting process and helps control odors.

Equipment Needs. Appropriate equipment must be available for initial mixing, turning, and hauling composted material and carbonaceous material. Appropriate long stem thermometers should be available for managing the compost material.

Bulking Materials. Bulking materials may be added to enhance air flow within the composting material. Static pile composting may require this to be effective. Piles that are too compact will inhibit the composting process. The carbonaceous material can be considered as a bulking agent. Where it is desirable to salvage carbonaceous material, provisions for removing the material, such as screening, must be made.

Management. Composting operations require close management. Management capabilities of the operator and availability of labor should be assessed as part of the planning and implementing process.

Economics. Benefits associated with the ultimate use of the composted material should be compared to the capital expenditure and operating costs of the composting operations. In addition to cost return, benefits can include environmental protection, improved handling, destruction of weed seed, disposal of dead poultry and other farm carcass, odor control, and reduced need for storage volume.

PLANS AND SPECIFICATIONS

Plans and specifications for a composting facility shall be in keeping with this standard and shall be site specific and provide all information necessary to construct the facility. Plans (construction drawings) developed for a composting facility shall be drawn to requirements outlined in Chapter 5, "Preparation of Engineering Plans" of the Engineering Field Handbook (EFH) and policy requirements in the National Engineering Manual (NEM). If additional conservation practices are to be built in conjunction with the Composting Facility, e.g. addressing outside water exclusion, treatment and distribution of liquid waste, etc., the information to construct these practices will also be conveyed on the plans.

As-Built-Plans. As-Built-Plans, when required by the approving individual, shall reflect all significant changes in alignment, cross section, structure location, etc. It is expected that all changes will be with prior consent of the individual approving the design. If there were no changes, the original drawings shall be marked, "As-Built."

OPERATION AND MAINTENANCE

A site specific written operation and maintenance plan shall be developed, (based on information in the Agricultural Waste Management Field Handbook AWMFH and full knowledge and input of the landowner), detailing the compost recipe, approximate times for the processing, size of operation it's designed for and an overview of common operational problems with recommended actions. Other Pacific Basin practices that are part of the same conservation plan can have their required activities consolidated into a single document for the system.

The operator should be made aware of management requirements associated with the practice early in the process and should be providing input into the planning, preliminary, and final design stages.